

Serial No.: 10/045,364
Docket No.: PHUS017043US (PII 3341)

Amendment After Final and
Request for Reconsideration

Listing of Claims

1. (Twice Amended) A fluoroscopic imaging apparatus comprising:
an x-ray source for projecting x-rays through a subject, the x-ray source having a voltage and a current associated therewith;
an x-ray detector for detecting radiation which has passed through the subject;
a monitor for displaying an image indicative of the detected radiation, the image defining a field of view;
an operator interface for defining a region of interest within the field of view wherein the region if interest is defined by an operator during image acquisition; and
enhancement means for enhancing, in response to image data within the region of interest, a subsequent image of the region of interest.
2. (Original) A fluoroscopic imaging apparatus according to claim 1 wherein the enhancement means comprises:
an image processor which generates a brightness histogram of pixels within the region of interest;
an automatic exposure controller which, in response to the brightness histogram, adjusts at least one of the voltage and current of the x-ray source; and
an automatic brightness controller which, in response to the brightness histogram, generates a lookup table for mapping pixels generated by the fluoroscopic imaging apparatus to a display scale for displaying the pixels on the monitor.
3. (Original) A fluoroscopic imaging apparatus according to claim 2 wherein the display of the region of interest has a brightness range and the brightness range is substantially constant.
4. (Original) A fluoroscopic imaging apparatus according to claim 3 wherein the automatic brightness controller includes a look-up table which maps a minimum brightness value from within the region of interest to black on the monitor and which maps a maximum brightness value from within the region of interest to white on the monitor.

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5. (Original) A fluoroscopic imaging apparatus according to claim 1 wherein the operator interface includes a pointing device for selecting a size and a location of the region of interest.

6. (Original) A fluoroscopic imaging apparatus according to claim 5 wherein the position of the pointing device is overlaid on the image.

7. (Original) A fluoroscopic imaging apparatus according to claim 1 wherein the region of interest is less than or equal to the field of view in size.

8. (Presently Cancelled) A fluoroscopic imaging apparatus according to claim 1 wherein the region of interest can be updated by the operator during image acquisition.

9. (Twice Amended) A fluoroscopic imaging apparatus for enhancing, in real-time, a display of a region of interest within a fluoroscopic image, the apparatus comprising:

an x-ray source for projecting x-rays through a subject, the x-ray source having a voltage and a current associated therewith for controlling the projected x-rays;

an x-ray detector for detecting radiation which has passed from the x-ray source through the subject;

display means for displaying real-time video images indicative of the detected radiation on a monitor;

a pointing device by which an operator ~~can define~~ defines a region of interest during image acquisition from within the video images;

an image processor for generating a histogram of image data of the region of interest;

an automatic exposure controller for controlling at least one of the x-ray source voltage and the x-ray source current in response to the histogram of the region of interest; and

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an automatic brightness controller for mapping the image data of the region of interest to a display scale of the monitor in response to the histogram of the region of interest.

10. (Original) A fluoroscopic imaging apparatus according to claim 9 wherein the histogram is generated using all pixels from within the region of interest.

11. (Original) A fluoroscopic imaging apparatus according to claim 9 wherein the operator can interactively select the size and location of the region of interest using the pointing device.

12. (Original) A fluoroscopic imaging apparatus according to claim 11 wherein the pointing device has a position which is overlaid on the real-time video images displayed on the monitor.

13. (Original) A fluoroscopic imaging apparatus according to claim 9 wherein the display of the region of interest has a brightness range and the brightness range is substantially constant between successive displays of the region of interest.

14. (Once Amended) A method of fluoroscopic imaging comprising the steps of:

projecting x-rays through a subject using an x-ray source, the x-ray source having a voltage and current associated therewith;

detecting radiation which has passed through the subject;

displaying on a monitor an image indicative of the received radiation, the image defining a field of view;

displaying borders of a region of interest, the region of interest being within the field of view and being defined by an operator during image acquisition and having a brightness and contrast associated therewith;

generating a brightness histogram of the image data within the region of interest;

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adjusting at least one of the x-ray source voltage and current in response to the brightness histogram of the region of interest whereby the display of the region of interest is thereafter enhanced; and

adjusting at least one of the brightness and contrast of the region of interest in response to the histogram of the region of interest whereby the display of the region of interest is thereafter enhanced.

15. (Original) A method of fluoroscopic imaging according to claim 14 wherein the step of generating a histogram includes using all pixels from within the region of interest.

16. (Original) A method of fluoroscopic imaging according to claim 14 wherein the step of adjusting at least one of the brightness and contrast of the region of interest includes mapping a minimum brightness from within the region of interest to black on the monitor and mapping a maximum brightness from within the region of interest to white on the monitor.

17. (Original) A method of fluoroscopic imaging according to claim 14 wherein the borders of the region of interest are superimposed on the display of the field of view.

18. (Previously Added) A fluoroscopic imaging apparatus comprising:
an x-ray source for projecting x-rays through a subject, the x-ray source having a voltage and a current associated therewith;

an x-ray detector for detecting radiation which has passed through the subject;
a monitor for displaying an image indicative of the detected radiation, the image defining a field of view;

an operator interface for selecting a region of interest within the field of view;
and

enhancement means for enhancing, in response to image data within the region of interest, a subsequent image of the region of interest;

wherein the operator interface includes a pointing device for selecting a size and a location of the region of interest and the position of the pointing device is

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overlaid on the image.

19. (Previously Added) A fluoroscopic imaging apparatus for enhancing, in real-time, a display of a region of interest within a fluoroscopic image, the apparatus comprising:

an x-ray source for projecting x-rays through a subject, the x-ray source having a voltage and a current associated therewith for controlling the projected x-rays;

an x-ray detector for detecting radiation which has passed from the x-ray source through the subject;

display means for displaying real-time video images indicative of the detected radiation on a monitor;

a pointing device by which an operator can select a region of interest from within the video images;

an image processor for generating a histogram of image data of the region of interest;

an automatic exposure controller for controlling at least one of the x-ray source voltage and the x-ray source current in response to the histogram of the region of interest; and

an automatic brightness controller for mapping the image data of the region of interest to a display scale of the monitor in response to the histogram of the region of interest;

wherein the operator can interactively select the size and location of the region of interest using the pointing device and the pointing device has a position which is overlaid on the real-time video images displayed on the monitor.